1. A method of calibrating a scanning probe microscope comprising:

applying an input signal to an actuator of a scanning probe microscope to cause acceleration of the actuator;

measuring a value indicative of deflection of a flexible structure attached to the actuator, as a result of the actuator acceleration; and

determining from the deflection value a corresponding value of actuator displacement.

2. The method of claim 1 wherein the input signal comprises a sinusoidal voltage signal.

3. The method of claim 1 wherein the flexible structure comprises a cantilever.

4. The method of claim 3 wherein the actuator displacement is a vertical displacement.

5. The method of claim 4 further comprising:

repeating the steps of measuring and determining for the application of different values of the input signal to the piezoelectric actuator to produce corresponding vertical displacement values within a predetermined range of vertical displacement values.

6. The method of claim 5 further comprising:

generating a calibration map relating the different input signal values to the corresponding vertical displacement values for use by the scanning probe microscope.

7. The method of claim 4 wherein measuring comprises measuring multiple values of the deflection over time and wherein determining comprises determining from the deflection values multiple corresponding values of the piezoelectric actuator displacement.

8. The method of claim 7 further comprising:

repeating the steps of measuring and determining for the application of different values of the input signal to the piezoelectric actuator to produce multiple corresponding vertical displacement values for each different input signal value within a predetermined range of vertical displacement values.

9. The method of claim 8 further comprising:

generating a hysteresis map relating the different input signal values to the multiple corresponding vertical displacement values for use by the scanning probe microscope.

10. The method of claim 3 wherein the cantilever comprises a piezoelectric material.

11. The method of claim 3 wherein the cantilever comprises piezoresistive elements.

12. The method of claim 1 wherein the scanning probe microscope comprises an atomic force microscope.

13. The method of claim 3 wherein the cantilever is coated with a magnetic material and the scanning probe microscope comprises a magnetic resonance force microscope.

14. The method of claim 1 wherein the actuator comprises a piezoelectric actuator.

15. A method of characterizing a sample using a scanning probe microscope comprising:

providing a probe at a first end of a cantilever having a second end mounted to an actuator; and

controlling the vertical displacement of the actuator to position the probe relative to a sample to be characterized;

wherein controlling comprises using a map to adjust input signals to the actuator used to produce the vertical displacement, the map comprising a mapping of input signals to the actuator to corresponding vertical displacement values obtained during a calibration by applying the input signals to the actuator and measuring a deflection of a calibration cantilever attached at one end to the actuator.

16. A method of characterizing a sample using a scanning probe microscope comprises:

providing a map to a controller of a scanning probe microscope having an actuator;

using the map in connection with a sample characterization task to compensate for nonlinear vertical displacement of the actuator; and

wherein the map comprises a mapping of input signals to the actuator to corresponding vertical displacement values obtained by applying the input signals to the actuator and measuring a deflection of a flexible structure attached at one end to the actuator.

17. The method of claim 16 wherein the flexible structure comprises a calibration cantilever comprising a selected one of a piezoelectric material, piezoresistive elements, and a magnetic coating material.

18. The method of claim 16 wherein the actuator comprises a piezoelectric actuator.

19. A scanning probe microscope calibration apparatus comprising:

an actuator;

a flexible structure having one end that attaches to the actuator;

a first circuit to apply an input signal to the actuator, thereby causing acceleration of the actuator;

a second circuit to provide a value indicative of deflection of the flexible structure as a result of the actuator acceleration; and

a third circuit to determine from the deflection value a corresponding value of displacement of the actuator.

20. The scanning probe microscope calibration apparatus of claim 19 wherein the input signal comprises a sinusoidal voltage signal.

21. The scanning probe microscope calibration apparatus of claim 19 wherein the flexible structure comprises a cantilever.

22. The scanning probe microscope calibration apparatus of claim 21 wherein the displacement is a vertical displacement.

23. The scanning probe microscope calibration apparatus of claim 22 wherein the first circuit is operative to apply different input signal values to the actuator to produce corresponding vertical displacement values within a range of vertical displacement values.

24. The scanning probe microscope calibration apparatus of claim 23 further comprising:

means for generating a map relating the different input signal values to the corresponding vertical displacement values for use by the scanning probe microscope.

25. The scanning probe microscope calibration apparatus of claim 21 wherein the cantilever comprises piezoelectric material.

26. The scanning probe microscope calibration apparatus of claim 21 wherein the cantilever comprises piezoresistive elements.

27. The scanning probe microscope calibration apparatus of claim 26 wherein the second circuit comprises a Wheatstone bridge circuit to measure change in resistance of the piezoresistive elements.

28. The scanning probe microscope calibration apparatus of claim 21 wherein the cantilever comprises capacitive elements.

29. The scanning probe microscope calibration apparatus of claim 19 wherein the actuator comprises a piezoelectric actuator.

30. A scanning probe microscope comprising:

an actuator;

a probe attached to a first end of a cantilever, a second end of which is attached to the actuator;

a controller to control the vertical displacement of the actuator to position the probe relative to a sample to be characterized, the controller configured with a map for adjusting input signals to the actuator used to produce the vertical displacement; and

wherein the map comprises a mapping of input signals to the actuator to corresponding vertical displacement values obtained by applying the input signals to the actuator and measuring a deflection of a calibration cantilever attached to the actuator.

31. The scanning probe microscope of claim 30 wherein the actuator comprises a piezoelectric actuator.

32. A scanning probe microscope comprising:

an actuator;

a probe attached to a first end of a cantilever, a second end of which is attached to the actuator;

a controller to control the vertical displacement of the actuator to position the probe relative to a sample to be characterized, the controller configured with a map for use in connection with the sample characterization to compensate for nonlinear vertical displacement of the actuator; and

wherein the map comprises a mapping of input signals to the actuator to corresponding vertical displacement values obtained by applying the input signals to the actuator and measuring a deflection of a flexible structure attached to the actuator.

33. The scanning probe microscope of claim 32 wherein the flexible structure comprises a calibration cantilever comprising a selected one of a piezoelectric material, piezoresistive elements, and a magnetic coating material.

34. The scanning probe microscope of claim 32 wherein the actuator comprises a piezoelectric actuator.

35. An article comprising:

a storage medium having stored thereon instructions that when executed by a machine result in the following:

causing an input signal to be applied to an actuator of a scanning probe microscope to cause an acceleration of the actuator;

obtaining a value indicative of deflection of a flexible structure attached to the actuator, as a result of the actuator acceleration; and

determining from the deflection value a corresponding value of actuator displacement.

36. The article of claim 35 wherein the actuator comprises a piezoelectric actuator.